Maciej Kos

Online: mkos.pl | GitHub | maciejkos@gmail.com
Offline: Brookline, MA

Education

Northeastern University, Boston, MA 2/2024
Ph.D. in ***Computer Science / Personal Health Informatics*** *(GPA: 4.0)*

Dissertation: Digital biomarkers of cognitive health: unobtrusive monitoring of cognitive changes using smartphones

Research interests: data science, machine learning, mHealth, health informatics, quantitative UX

Selected awards:

- **ACM/Intel Corporation Computational and Data Sciences Fellowship**, 2017 – 2021
- **NIH National Institute of Aging, Predoctoral Fellow (F99)**, 2020 - 2023
- Network Science Institute Seed Grant, 2021
- Northeastern University Dissertation Grant, 2020
- **Google Scholar**, 2020
- Grace Hopper Conference, 2019 – Google Travel Award

[Multiple conference, workshop, and summer school awards omitted]

University of Michigan, Ann Arbor, MI 12/2012
M.A. in ***Information Science***

Barcelona Graduate School of Economics, Barcelona, Spain 07/2009
M.Sc. in ***Economics of Science and Innovation***

Experience

Northeastern University Boston, MA
Graduate Researcher 09/2015 – present

"Digital Biomarkers of Cognitive Health" *(Dissertation), with Dr. Pavel and Dr. Rampersad*

- To infer changes in cognitive function, I developed software and algorithms for collecting and analyzing smartphone data collected passively (location and motion, typing speed and frequency of errors, app use, and screen events).
- Designed cognitive lab experiments, including cognitive and motor tasks, and EEG. Recruited participants using online ads, primarily Meta Ads.

"Measurement of collective physical distancing during the COVID-19 outbreak using large-scale mobility data" in collaboration with the MOBS lab, PI: Alessandro Vespignani

- Developed an approach for reducing selection bias in smartphone location data of over 40 million US users by combining well-established statistical techniques with multivariate simulations applied to geospatial socio-demographic data (Python, R).
- Helped build a pipeline for processing over 0.5 petabytes of data (Python, BigQuery).

"Strengthening Human Adaptive Reasoning and Problem-solving" in collaboration with Harvard, Oxford, and HoneyWell

- Built a statistical model to characterize the relationship between different types of brain stimulation, estimates of fluid intelligence, and performance during adaptive cognitive training (R).
- Helped develop a computational model of participants' performance during adaptive cognitive training (R).

"WearTech - determining the accuracy of wearable sensors for ambulatory stress monitoring"

- Used machine learning and signal processing techniques to develop a method for removing motion artifacts from heart rate data (R).
- The developed method improved upon Microsoft's state-of-the-art algorithm.

Roku Remote

Research Data Scientist Intern 06/2021 – 09/2021

"Development and assessment of algorithms for creating lookalike audiences (ads)"

- Implemented and assessed methods for creating lookalike audiences using behavioral data (lift > 20x)
- Proposed novel algorithms for lookalike creation.

Google San Francisco, CA

UX Research Intern (quantitative) 05/2019 – 09/2019

"Quantification of Material Design (Google's open-source design system)"

- Developed an algorithm for computing website's cognitive complexity based on Shannon's entropy.
- Prototyped analytics pipeline to parse 400 billion pages and fuses Google's diverse signals about each website (e.g., vertical, location, reach).

Philips Healthcare Research Cambridge, MA

Research Intern (Clinical Data Analytics) 05/2018 – 09/2018

"Intensive care unit of the future: health informatics technologies for preventing critical illness brain injury (CIBI)"

- Proposed and prototyped system architectures and UX of two clinical decision. support systems for preventing delirium and CIBI using ICU data.
- Submitted two patent applications (internally).

Polish National Science Center, Research Grant Poland & Boston, MA

Investigator and Research Group Manager 07/2013 – 05/2018

"Genetic health-risk information avoidance"

- Conceptualized the study and wrote Research Strategy of a winning grant application ($77 000; the largest grant awarded to researchers at the economics department).
- Wrote software for running online experiments, managed online and offline experiments with > 1000 participants (Python).
- Analyzed data and presented findings at four conferences.

Agile Axons (self-employed) Poland and Rome, Italy

User Experience and Research Consultant 01/2013 – 08/2015

- Led a UX team developing a consumer-facing mobile app for a large Italian telco (with **McKinsey** and **Ericsson**).
- Consulted on research design and statistical programming for behavioral finance and economics projects.

Other: Research Assistant (University of Michigan), Localization Tester (EA), and more.

Skills

Programming: Python, R, Stata, SQL (GCP BigQuery, AWS Athena)

Statistics: GLM (univariate, multivariate, some multilevel), SEM, psychometric modeling

Machine Learning/AI: dimensionality reduction, clustering, SVMs, ridge regression, logistic classification, random forests, sequential pattern mining, LLM few-shot learning / fine-tuning

Other: data visualization, network analysis, qualitative UX research

Eager to learn: signal processing, computer vision, deep learning, NLP

Side Projects

Child Aid: analyzed data and consulted on research design for a large-scale experimental intervention to increase literacy of Guatemalan children.

Lives of Dissidents: led UX research and design effort to help launch a charity project dedicated to spreading the message of peaceful dissent as a means of dissolving oppression.

Additional Activities

- Ad hoc reviewer for SIG Human-Computer Interaction, IEEE Engineering in Medicine and Biology Society, and American Medical Informatics Association, PLOS ONE
- Northeastern Personal Health Informatics Faculty Committee, 2018/2019 – elected student representative
- Personal Health Informatics seminar, 2016/2018 – organizer
- University of Michigan, Rackham's International Connect, 2010/2011 – mentor
- Poland Foresight 2020 national research program – external expert
- Baltic Science Festival, 2007/2008 – departmental coordination team member

Papers, Presentations, and Posters (selected, peer-reviewed, and not peer-reviewed)

1. Klein B., LaRock R., McCabe S., Torres L., Friedland L., **Kos M.**, Privitera F., Lake B., Kraemer M., Brownstein J.S., Gonzalez R., Lazer D., Eliassi-Rad T., Scarpino S.V., Vespignani A., Chinazzi (2024). *Characterizing the collective physical distancing of the United States during the first nine months of the COVID-19 pandemic*. (Paper under review.)
2. Jimison, H., **Kos M.**, Pavel, M. (2022). *Early Detection of Cognitive Decline Via Mobile and Home Sensors*. In: Hsueh, PY.S., Wetter, T., Zhu, X. (eds) Personal Health Informatics. Cognitive Informatics in Biomedicine and Healthcare. Springer, Cham. Online version: https://rdcu.be/c1niL
3. M. (2020). *Reshaping a nation: Mobility, commuting, and contact patterns during COVID-19*.
4. Pavel M., Caves K., Jarvis L., Hasson C.J., **Kos M.**, Jimison H. (2021). *Unobtrusive, Continuous LIDAR-Based Measurement of Gait Characteristics at Home*. Paper presentation at the 43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Virtual
5. Klein B., LaRock R., McCabe S., Torres L., Friedland L., **Kos M.**, Privitera F., Lake B., Kraemer M., Brownstein J.S., Lazer D., Eliassi-Rad T., Scarpino S.V., Vespignani A., Chinazzi M. (2020). *Reshaping a nation: Mobility, commuting, and contact patterns during COVID-19*. Presentation at COVID-19 Satellite of Sunbelt XL, International Sunbelt Social Network Conference, virtual
6. **Kos M.** (2020). *Towards a digital biomarker of cognitive health: passive monitoring of cognitive changes using smartphone-based data*. Poster presentation at the Computing Research Association Grad Cohort Workshop, Austin, TX
7. **Kos M.**, Yew J. (2019). *Computational methods for understanding cognitive density preferences; foundations for adaptive user interfaces*. Google Ph.D. Intern Research Conference, Mountain View, CA
8. **Kos M.**, Pavel M., Jimison H. (2019). *How to Validate Heart Rate Monitoring Wearablesfor Just-in-Time Adaptive Health Interventions? Development of Comparison Testing Guidelines*. Poster presentation at the Annual American Medical Informatics Association Symposium, Washington, DC
9. **Kos M.**, Ponnada A., Pavel M., Intille S. (2019). *Evidence That Microinteraction Ecological Momentary Assessment (μEMA) is a Non-Reactive In-Situ Affect Assessment Method*. Poster presentation at the Society for Affective Science Annual Conference in Boston, MA
10. **Kos M.**, Gordon C., Li X., Khaghani-Far I., Pavel M., Jimison H. (2017). *The Accuracy of Monitoring Stress from Wearable Devices*. Poster presentation at the Annual American Medical Informatics Association Symposium, Washington, DC
11. **Kos M.**, Li X., Khaghani-Far I., Gordon C., Pavel M., Jimison H. (2017). *Can accelerometry data improve estimates of heart rate variability from wrist PPG sensors?* Paper presentation at the 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, South Korea